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ADDRESS IN STATE MEDICINE.

Recent Advances in Preventive
Medicine.

BY

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RECENT ADVANCES IN PREVENTIVE MEDICINE.

Progress in any branch of science or art may be measured in two ways: by the number and character of new discoveries made; or by the gradual advances in the application of knowledge previously acquired. Judged by either of these criteria the record of the past year is a creditable one to the comparatively newly cultivated field of State Medicine. In the brief time at my command, I shall endeavor to sketch concisely, and in outline merely, what has been accomplished during the year in this domain.

EPIDEMIOLOGY AND ENDEMIOLGY.

Adverting first to the extension of the fifth great pandemic of *Asiatic cholera*, which began in 1883, it will be seen that the danger of an invasion of this country has not yet passed; but that, on the contrary, it is greater than at any time within the last three years. Both in 1886 and in the present year the disease has continued in Southeastern Italy, and in the Austrian dominions at the head of the Adriatic.

In Japan the epidemic began in the summer of 1885, and after a period of cessation during the winter recurred in 1886. In the latter year there were 154,373 cases, with 101,695 deaths.

In November, 1886, cholera was carried to South America, in an Italian ship, the "Perseo," bound from Genoa to Buenos Ayres. The disease rapidly spread in the Argentine Republic, and crossing the Andean range invaded the Pacific coast of the South American continent.

If the present geographical distribution of cholera be taken in view, it will be seen that the United States are threatened by an invasion of this disease from three sources; first, from Europe, by way of the Atlantic ocean; second, from Japan by way of the Pacific ocean; third, from the west coast of South America



by way of the Pacific ocean, or by way of Mexico and our Southern border. The Isthmus of Panama and the South Atlantic transportation lines may also act as gateways to the infection. The present apparent lull in the activity of the disease should not tempt health authorities to relax their vigilance, or neglect the precautions inculcated by sanitary science.

The investigations into the etiology of cholera have proceeded on the lines marked out by Koch, in his Egyptian and Indian researches. The conclusions arrived at by Dr. Shakespeare, who was sent to Spain to study the disease, by the United States Government, are that the discovery of the cholera spirillum by Koch places in the hands of the profession an infallible means of diagnosis. Dr. Shakespeare does not commit himself to the view that the spirillum is the absolute cause of the disease. The general tendency among bacteriologists is, to accept the views of Dr. Koch, both in regard to the infective agent, and to the medium through which the infection gains entrance to the body, namely, contaminated food and drink. Pettenkofer, however, though admitting the agency of the spirillum, still maintains the necessity of certain local and temporary conditions of soil, more particularly in relation to the movements of the ground-water, in order to produce an outbreak. It may be stated casually that Dr. Shakespeare reports that the results of Señor Ferrán's inoculations were more favorable than the profession were led to believe at the time they created so great a sensation.

Yellow Fever appeared within the limits of the United States at only one place during the year, namely, at Biloxi, a summer resort on the Gulf coast of Mississippi. The proximity of Biloxi to Ship Island, the national quarantine station, probably accounts for the appearance of the fever at the former

NOTE.—Near the end of May, 1887, yellow fever broke out in Key West, Fla., but had not assumed the dimensions of an epidemic at the date of delivery of this address.

place. Prompt enforcement of sanitary measures, such as isolation of patients and disinfection of surroundings soon put an end to the outbreak.

The claims of Drs. Domingos Freire, of Brazil, and Carmona, of Mexico, concerning protective inoculation against yellow fever have been reiterated during the year. The latest information upon this important subject available comes in the shape of a dispatch from the United States Consul at Maracaibo, Venezuela, who reports under date of March 7, 1887, that Dr. Bustamente of Cucuta, Columbia, had practised inoculation with success. The following quotation is from Dr. Bustamente's letter: "For the present I will confine myself to the statement that in more than forty persons whom I have inoculated, a fever, with many of the characteristic symptoms of yellow fever, has presented itself. This fever developed by inoculation, varying several tenths of a degree, and in some cases ascending to 41° C. (105.5° Fahr.) but never presenting the most grave symptoms of yellow fever. The result of my observations permits me to state positively that the fever produced by inoculation is attended with no danger, and it is safe to inoculate, as I have already done, from children two years of age to the oldest individuals. Many of the persons inoculated have come to this city, and in no case has the yellow fever attacked them which gives me hope of a final result completely satisfactory." Dr. Bustamente also states that the municipality of Cucuta, assisted by private enterprise, has dispatched a commission, composed of two physicians, to Mexico to study the inoculation of the fever.

In Brazil and Mexico the inoculations are said to amount to many thousands and complete success is claimed by Freire and Carmona and their partisans. Others have, however, expressed grave doubts of the accuracy of the observations published. The last Congress, recognizing the importance of a solution of this question to the people of the United States,

authorized the appointment of a commission to proceed to South America and Mexico and thoroughly investigate the validity of the claims of Drs. Freire and Carmona. President Cleveland, with the good sense characteristic of him when dealing with scientific interests has appointed Major George M. Sternberg, Surgeon U. S. Army, as the Commissioner to perform this duty. The profession and the public may look forward with confidence to a thorough and unprejudiced investigation of the claims of Freire and Carmona. Dr. Sternberg sailed for Brazil on May 4, to begin his researches at the home of Dr. Freire.

Limited outbreaks of *small-pox* occurred during the year in New York city and Brooklyn and at Los Angeles in Southern California. At the latter point the disease was introduced from Mexico. At present the epidemic seems to be well under control by the State Board of Health and local sanitary authorities.

In this connection, reference may be made to the discussion recently re-opened by Dr. Fleming, the distinguished English Veterinarian seconded by the accomplished editor of the *New York Medical Journal* (Dr. Frank P. Foster), on the doctrine of identity of human variola and cowpox. Dr. Fleming believes he has shown the doctrine to be a fallacy, and in this view is strongly supported by Dr. Foster. According to Dr. Foster, the supposed vaccinations of over three thousand persons with the virus of variolated cows, and its successive humanized cultures, made by Ceely and Badcock, of England, Adams, of Massachusetts, and Knight, of Baltimore, were merely inoculations of variolous matter which had not undergone any modification in consequence of its transmission through the bovine subject. This is equivalent to saying that experienced observers as those above mentioned certainly were, are unable to perceive the the clinical difference between vaccinia and inoculation-variola. From such a point of view most clinical observation could be called in question. No evidence

whatever is on record proving that cow-pox is anything other than variola as it affects the cow. Negative testimony based upon failures to inoculate small-pox virus upon cows by certain observers, can have no force in face of the comparatively numerous positive results obtained by others. Cumulative increase of such negative evidence does not add to its strength.

The admitted dangers of humanized vaccine from syphilis and perhaps other diseases, and the many inconveniences attending the use of bovine virus—such as prolonged incubation, untrustworthy supply, etc., have stimulated endeavors to cultivate the microbe upon which the infective power of vaccine virus may reasonably be assumed to depend. In an extended series of experiments recently made, Dr. John Dougall, already favorably known for his accurate work in the field of bacteriology, has attempted to secure this result but without success. Where pure cultures of an organism were obtained through successive generations, it was found that the infectiveness of the microbe was lost. Hence, the experiments of Dougall even failed to demonstrate whether the organisms found were specific. Garré, a German bacteriologist, has also quite recently investigated the subject, with more success. His pure cultures were inoculable upon animals but not upon man. In the vesicles resulting from the inoculations the same organisms that composed the culture were found. While these results are indefinite, they encourage us to look for success in the near future.

Whether the protective power of vaccination is permanent or whether it diminishes in the course of time is still occasionally the subject of discussion in sanitary publications. In recent papers Wolfberg has carefully reviewed the entire question from various points of view, and has arrived at the conclusion that the protective influence of vaccination does not

diminish, but that the natural susceptibility to small-pox increases in the human subject after the fifteenth year of life. Hence, re vaccination after that age is an important safeguard. The inference derived from these studies of Wolffberg would seem to be that a thorough vaccination at or after the fifteenth year is protective for life.

Scarlet Fever, one of the most fatal plagues of infantile life, has attracted especial attention in connection with the startling assertion of its apparent origin from a disease occurring in cows. The evidence in support of this claim is briefly as follows: Mr. W. H. Power, of the English Local Government Board, was detailed to investigate certain outbreaks of scarlet fever, which seemed to have especial relation to the milk supply from a particular dairy farm. Upon inspection this dairy was found to be in excellent sanitary condition as regards cleanliness, water supply, sewerage, etc., and for a time considerable difficulty was experienced in locating the cause of the outbreaks. Improbable, as it may at first sight appear, it seems to have been incontestably established, that the epidemics of scarlatina were due to the use of milk obtained from cows attacked by a peculiar disease manifested in general by a vesicular eruption followed by ulceration of the udder. The chain of circumstances connecting the disease in the cows with the outbreaks of scarlet fever in certain districts in London, supplied with milk from the diseased cows, was so strongly forged by the able investigator into whose hands the work had been committed by the authorities, that no doubt can exist that the one disease owed its origin to the other.

The same outbreaks were studied by the eminent pathologist, Dr. Klein, from another point of view. Procuring some material from the ulcerated udders of the sick cows, he cultivated a micro-organism, which, when inoculated into healthy calves, produced in them lesions similar to those existing in

cows from whom the material was obtained. Dr. Klein has found a micrococcus presenting similar characters in the blood of scarlet fever patients. Mice fed with cultures from both these sources were similarly affected. From the blood of the infected mice the same micro-organism was obtained and cultivated. When re-inoculated upon calves it produced identical lesions with the material from the diseased cows. Thus the proof seems complete that a disease of cows heretofore considered unimportant is identical in nature with one of the most dreaded diseases affecting the human race. That the etiological factor of scarlet fever is a bacterial organism seems also to be satisfactorily demonstrated by the researches of Dr. Klein. These discoveries when fully appreciated, must exert a beneficial influence upon the efforts of sanitary authorities to restrict this fatal disease. A conviction of the bacterial nature of scarlet fever will tend to impress upon physicians the importance of personal measures of prevention. If, as is generally assumed, the infective agent of scarlet fever is contained in the epidermis, thorough disinfection of the surface of the body will reduce the period of infectiveness of the person who has passed through an attack. Instead of six to eight weeks, as now recommended, the period of isolation, when accompanied by appropriate measures of disinfection, may probably be reduced to one week after the cessation of the active symptoms. This gain of time will often be a matter of great importance. That even the less complete measures of isolation and disinfection heretofore practiced in certain places are effective, is demonstrated by Dr. Henry B. Baker, the efficient secretary of the State Board of Health. He has shown most conclusively in a statistical table recently published, that the general practice of restrictive measures in scarlet fever, by the people of Michigan, since 1887, has resulted in a probable annual saving

in that State of 338 lives from this one disease. These results likewise show the value of an efficient, public spirited, and wide-awake State Sanitary organization.

Dr. Baker has also recently published an abstract of his researches into the causation of *pneumonia*. From a study of the meteorological conditions for a long series of years together with the varying prevalence of pneumonia, he finds that certain meteorological elements are so uniformly associated with sickness from pneumonia as to make it appear that they bear an etiological relation to that disease. These meteorological elements are the amount of ozone, the temperature, the relative and absolute humidity, the velocity of the wind, and, in a measure, the atmospheric pressure. Unfortunately all of these conditions are so closely related and dependent one upon another, that no one of them can be picked out as the most important factor. However, Dr. Baker believes that the temperature of the outside air, governing to a great degree the other meteorological conditions mentioned is the main factor to be taken into account. Graphic charts which he has constructed show a very close relation between the average temperature and the sickness from pneumonia; "and the curves representing sickness from pneumonia follow uniformly at such a period after the temperature curves as to make it seem certain that the sickness is directly or indirectly caused by a comparatively low temperature."

The established relation of pneumonia morbidity to a cold, dry atmosphere suggests certain measures for the prevention of the disease. Such measures would be to secure to as great a degree as possible, warm, moist air for respiration. How to accomplish this both within and without doors is a problem to tax the ingenuity of the practical.

I may call attention also in this place to the clinical reports of outbreaks of infectious pneumonia by

A comparison of the deaths from Scarlet Fever, reported to the Secretary of State as having occurred in Michigan during the five years (1869-73) just preceding the organization of the State Board of Health, with the three years (1874-76) immediately succeeding its organization, and those three years (1874-76) with the eight years (1877-84), during which the document on Restriction of Scarlet Fever was distributed; also the five years (1869-73) just before the establishment of the Board, with the eight years (1877-84) during the use of the document; and finally, a comparison of the five years (1869-73) just preceding the work of the Board, with the eleven years (1874-84) since the State Board of Health was established.

Periods of Time Compared.	Estimated Average Population.	Average Deaths Reported per Year.	Total Reported Deaths.	Average Reported Deaths per Year per 10,000 Inhabitants.	Decrease of Deaths per Year per 10,000 Inhabitants.	Average Decrease of Reported Deaths per Year. ¹	Lives Probably Saved According to the Reports. ²
{ 5 years, 1869-73... { 3 years, 1874-76...	1,215,220 1,384,515	589 421	2,945 1,262	4.85 3.04	1.81	252	756
{ 3 years, 1874-76... { 8 years, 1877-84...	1,384,515 1,689,988	421 449	1,262 3,595	3.04 2.66	.38	64	512
{ 5 years, 1869-73... { 8 years, 1877-84...	1,215,220 1,689,988	589 449	2,945 3,595	4.85 2.66	1.19	370	2,961
{ 5 years, 1869-73... { 11 years, 1874-84...	1,215,220 1,609,023	579 442	2,945 4,857	4.85 2.75	2.10	338	3,718

¹ Probably not all deaths were reported before or since the organization of the Board, consequently the saving is probably greater than is here shown. Allowing for increase of population.

Graham, Lee, Thane and others, as well as to the recent researches upon the micro organism which is supposed to be the cause of lobar pneumonia. So far as the latter is concerned, pathologists have not yet arrived at unanimity. Weichselbaum found organisms in every one of a series of 129 cases. The microbes found were of four different forms: 1. A diplococcus which seems to be morphologically and biologically identical with Sternberg's *Micrococcus Pasteuri*. This was present in the lungs or sputa of 94 cases. 2. A streptococcus which was found in 21 cases, none of them of the croupous, or lobar, variety. 3. *Staphylococcus pyogenes aureus* and *albus*, the organisms of pus. These were present in 5 cases of secondary pneumonia; and 4, a bacillus or oval micrococcus, which presents all the characteristics of Friedlander's so-called "pneumococcus," was present in only 9 of the cases.¹

Weichselbaum also confirms the statement first made by Sternberg, that organisms similar to, or identical with those found in the lungs in pneumonia (*micrococcus Pasteuri*, Sternberg) are often found in the secretions of the mouth and respiratory tract in healthy individuals. Hence, while the microbes mentioned, and especially the *M. Pasteuri*, must be looked upon as the specific agents in producing pneumonia, certain predisposing agents are necessary to enable the organisms to proliferate and produce their pathological effects. The predisposing or favoring causes may perhaps be found in the atmospheric conditions claimed by Baker to stand in close relation with the prevalence of pulmonary inflammation. There seems every reason to believe that a solution of this important question is near at hand.²

¹ "We may eventually find that there are various pneumonia-cocci, just as we have learned that the pus of acute abscesses contains sometimes one and sometimes another coccus; or, again, two or more in association." Sternberg, Trans. Path. Soc. Phila., vol. xii.

² "The constant presence of this micrococcus in the buccal secretions of healthy persons, indicates that some other factor is required for the

The contagiousness of *tuberculosis*, and its dependence upon the bacillus discovered by Koch, seem to be so well established that rational measures for the restriction of this most fatal and universal of all pestilences should command the attention of physicians and the public. It is coming to be accepted that phthisical patients should not be treated in the same hospital wards with non-tuberculous individuals.

A tuberculous patient in a hospital ward must be regarded as a constant focus of infection from which the disease is spread. Prompt disinfection of the sputa and other discharges of the tuberculous individuals will doubtless reduce the cases by diminishing the opportunities for infection. At the conference of the State Boards of Health of this country held in Toronto, last October, a resolution was adopted to the effect "that it now seems probable that progress can be made in the restriction of consumption by declaring to the people that care should be taken to destroy or disinfect the sputa from persons suffering from pulmonary consumption." This public declaration of the foremost sanitarians of America is worthy of the careful consideration of every one interested in the prevention and cure of this deadly malady.

In concentrating our attention upon the pernicious effects of the bacillus tuberculosis, however, we

development of an attack of pneumonia; and it seems probable that this other factor acts by reducing the vital resisting power of the pulmonary tissues, and thus making them vulnerable to the attacks of the microbe. This supposition enables us to account for the development of the numerous attacks of pneumonia which cannot be traced to infection from without. The germ being always present, auto-infection is liable to occur when, from alcohol, sewer-gas poisoning, crowd poisoning, or any other depressing agency, the vitality of the tissues is reduced below the resisting point. We may suppose, also, that a reflex vaso-motor paralysis, affecting a single lobe of the lung, for example, and induced by exposure to cold, may so reduce the resisting power of the pulmonary tissue as to permit this micrococcus to produce its characteristic effects.

"Again, we may suppose that a person, whose vital resisting power is reduced by any of the causes mentioned, may be attacked by pneumonia from external infection with material containing a pathogenic variety of this micrococcus having a potency, permanent or acquired, greater than that possessed by the same organism in healthy buccal secretions." Sternberg, *ibid.*

should not lose sight of the fact that other circumstances must be considered in accounting for the origin and spread of consumption. The epoch making discovery of the causal agency of soil moisture, by Dr. H. I. Bowditch, over twenty-five years ago, is apparently confirmed by the result of a study of the topographical distribution of phthisis in Pennsylvania made by Dr. William Pepper during the past year. Other predisposing conditions, such as defective ventilation, insufficient or improper food, and other depressing agencies, must be admitted as at least predisposing to the development of the disease. There is danger that a too exclusive attention to the microbial factors of disease will narrow our views of epidemiology and preventive medicine. As there is more in pathology than the discovery and culture of bacteria, so there is more in preventive medicine than the discovery and application of microbicides.

The micro-organism first described in 1880 by Eberth as the cause of *typhoid fever* has now obtained general recognition, and a number of careful researches during the past year seem to have firmly established its etiological importance. In a paper read before the Association of American Physicians last year, Sternberg has given a summary of all the experimental evidence available up to that time, and concludes that it is convincing as regards the etiological rôle of this bacillus.

If we regard the evidence in favor of the causal relation of this microbe as sufficient, and accept the conclusions of most epidemiologists, that the typhoid poison is contained only in the intestinal discharges, and by gaining access to drinking-water spreads the disease when taken into the stomach of susceptible individuals, some recent bacteriological investigations will claim our interest.

Meade Bolton, Wolffhügel and Riedel, and Percy Frankland have studied the behavior of different

micro-organisms in water of various degrees of purity. While Bolton arrived at the conclusion that pathogenic bacteria—typhoid bacillus, staphylococcus aureus, etc.—rapidly lost their vitality in water, the other observers mentioned found that these organisms increased. Cholera spirilli were found to become apparently acclimated to the water, and preserved their activity seven months after they were added to the water. Prudden has also shown, in a recent research, that typhoid bacilli contained in water are not entirely destroyed by freezing, even after remaining in this condition for 103 days.

Further, Chantemesse and Vidal have recently demonstrated the presence of the typhoid bacillus in water from a well at Pierrefonds, near Paris, which had caused a small outbreak of typhoid fever. Now, these facts, taken in connection with extensive epidemics of typhoid fever, such as that occurring at Plymouth, in Pennsylvania, in 1885, which was undoubtedly traceable to infected water, point irresistibly to the conclusion that the only practical way to prevent typhoid fever is to disinfect promptly and thoroughly all the alvine discharges of the patient, before emptying them out of the vessel in which they are received. During the past winter, the Committee on Disinfectants of the American Public Health Association has concentrated its labors upon the determination of the best means of destroying the typhoid infection. The results of this research have not yet been published, but I am able to state that the Committee will, before the end of this year, place at command of the profession the means to absolutely prevent the spread of typhoid fever, provided the disease-producing cause is developed only in the intestinal canal of those sick with this disease.

PUBLIC DISINFECTING STATIONS.

Disinfection, or the destruction of the infective power of infectious material occupies to-day a higher

place in the practical applications of preventive and curative medicine than ever before. Merely referring to the exact experimental observations upon the relative value of various articles used as disinfectants, published last year under the auspices of the American Public Health Association, and to be supplemented during the present year by some very important results, I would call attention to the establishment of public disinfecting stations, as lately put in operation in some European cities. In Berlin, Dusseldorf, Gottingen, Strasburg, Breslau, Leipsig and Danzig such disinfecting stations are now in use and at the command of the public, under proper official control. Steam under pressure is used at most of the above as the disinfecting agent, although at some super-heated steam not under pressure is employed. Sanitarians generally prefer the former. Such disinfecting establishments should be established in every American city and free to everybody. They should be under the control of the health authorities who should be held responsible for their proper management. In all contagious and infectious diseases, all possibly infected objects should be disinfected. The attending physician should decide when and for what objects disinfection is necessary. If any physician fails to recognize the importance of this prophylactic measure, his record as purveyor of contagious diseases will soon become known in the community in which he practises and the intelligent portion of the public will learn to avoid him. That the public are not opposed to availing themselves of the advantages of these institutions is shown by the experience of the station in Leipzig, to which articles not infected, but simply requiring cleaning, such as pillows and feather beds, were sent, because by the action of steam the elasticity of the feathers was restored. Some control is therefore necessary to prevent persons using the disinfecting stations as free laundries. This control is best placed in the hands

of the attending physician without whose order no one should have a claim for free disinfection. The physician can best decide in any case as to the necessity or non-necessity of this procedure.

With the definite, scientific character to which practical disinfection has of late been brought, sanitarians are beginning to consider whether quarantines of detention and observation may not be largely abandoned. The success of the system of "maritime sanitation"—in other words thorough disinfection, practised at the Louisiana quarantine station under the intelligent and energetic direction of Dr. Joseph Holt during the past three years, has demonstrated that quarantine must mean in the future something entirely different from what it meant in the past. The quarantine of the future will not be an obstruction to commerce or a hindrance to international intercourse.

M. Proust has during the present year, in a paper read before the French Academy of Medicine, suggested a distinct advance in this direction. He advises that in cases of outbreaks of infectious disease upon vessels disinfection should be performed on board during the voyage. The patients should be promptly isolated and all infected articles disinfected by means of steam under pressure. In order that this may be efficiently accomplished, every passenger vessel should have a physician subject to the orders of the Government authorities and independent of the navigation companies. M. Proust points to the success of the plan proposed by him, on the "Mytho," a French transport from Tonquin, upon which cholera was stamped out by sanitary measures during the voyage.

The lack of care exercised by trans Atlantic steamship companies concerning the importation of small-pox and other contagious diseases, calls forcible attention to one of the points in M. Proust's paper; namely: that relating to the independence of steam-

ship physicians. It is certain that if the medical officers of the trans Atlantic steamship lines derived their authority from government instead of from the steamship companies, the landing of cargoes of living small pox, yellow fever and cholera material upon our shores would be very much diminished, and inland State and City boards of health could look with more equanimity upon the sanitary shortcomings of the quarantine establishments at most of the Atlantic seaports.

FINAL DISPOSAL OF GARBAGE AND SEWAGE.

Intimately connected with the question of public disinfection is that of the disposal of the refuse of cities—garbage in the widest sense. In this field decided advances have been made. On the one hand new methods for the inoffensive destruction of city wastes have been devised, and on the other, older methods whose utility has been disputed, have had their value confirmed by a large amount of concurrent evidence.

“Purification by fire” has been for some years the *mot du guêt* with many sanitarians. And there can be no doubt that crematory destruction of garbage is absolute so far as noxiousness of the residue of the material so treated is concerned. But although the successful adoption of the system of garbage cremation by the municipalities of Montreal, Canada, and of Wheeling, West Virginia, has given this method a boom in State Medicine circles, it is absurd to make the claim that it is the only safe and effectual means of disposing of city offal.

The final disposal of sewage (fecal matter and house wastes by the separate system of sewerage; or these *plus* storm water and street washings by the combined system) has long been an intricate problem in sanitary administration. The self-interest of municipal corporations that for mercenary considerations empty their refuse into a stream which may

be or become the source of water supply for their neighbors must be checked. We have in this country an example of the offender confessing judgment and putting a stop to the practice on the moral ground of its unrighteousness; thus proving that corporations are not always soulless.

The irrigation system of sewage disposal which has steadily won favor among American sanitarians in recent years, has been greatly extended in Germany during the past year. In Berlin, where it has been in operation for some time, it has given great satisfaction. That portion of the city from which the sewage is carried to the irrigation fields has a population of nearly nine hundred thousand or about two-thirds of the whole. The water drained from the irrigation fields is submitted to a chemical examination every month. For the year ending March 31, 1885, only a single instance occurred in which the analysis showed marked pollution. This was afterward ascertained to be due to too rapid percolation of the sewage at one point, resulting in a direct mingling of the sewage with the "filtered" water. In 1885 there were 5,374 hectares (13,275 acres) of land used as sewage farms by the Berlin municipality. The proportion of inhabitants estimated to each hectare is 240; (about 100 to the acre). At this rate the above number of acres would be nearly sufficient to dispose of the sewage of the entire population of Berlin by irrigation. In Danzig, on the shores of the Baltic, where the soil is sandy, one acre suffices for the sewage of 240 people. In this city sewage irrigation has been practised for fourteen years. The coldest weather does not interfere with the irrigation. From February 23 to March 4, 1886, the temperature varied from 21° to 13° F. without checking the process of irrigation. The low temperature of our winters is sometimes cited as an objection to the introduction of the irrigation system in the Northern and Western portions of the

United States, but this experience of the city of Danzig, corroborated, as I am informed, by that of Pullman, in Illinois, and of other places in this country invalidates the objection.

In Breslau, Germany, a city of about 300,000 inhabitants, the irrigation system has also been adopted. At the close of last year about 1,600 acres of land in the vicinity of the city were under cultivation for sewage farming. The system which is being gradually extended, is very popular. There are now nearly 6000 premises connected with the sewers. The cost to each householder so connected, is less than the former method of removing fecal matters, and as the number of sewer connections increase, the cost to each property owner is proportionately diminished.

In some other German cities, where the physical or topographical conditions render the irrigation system impracticable, chemical precipitation of the sewage is practiced. Various methods of chemical purification are in use in Frankfort, Wiesbaden, Halle, Essen and Ehrenfeld, and all seem to be more or less successful. Most of them have only been in operation during the past year so that nothing definite can yet be said about their ultimate success. It is said that the cost per head is about the same as that of well administered irrigation fields. A board of distinguished engineers has recently advised the adoption of this system by the city of Providence, Rhode Island.

The principal difficulties encountered in the management of chemical purification systems are the nuisance created during the sedimentation of the solid portions, and the disposal of the manurial product to advantage. The same objections are urged against the various pneumatic systems, which seem to have made no progress in the favor of sanitarians abroad during the past year.

In England the irrigation system has been in use

for many years and has given general satisfaction. The city of Birmingham, with over 600,000 inhabitants, has adopted it, and with a daily discharge of sixteen million gallons of sewage finds an area of twelve hundred and twenty-seven acres of land "amply sufficient" for the purpose of an irrigation field. The income realized during 1885 from the sale of stock and produce from the sewage farm amounted to over \$100,000.

POISONOUS AND ADULTERATED FOOD.

The brilliant discovery of a new and very poisonous ptomaine in certain cheese by Prof. Victor C. Vaughan, of Michigan, several years ago has been followed by the demonstration of the same substance in ice cream, which had produced symptoms of poisoning in a large number of persons who had partaken of the cream. Subsequently Dr. Vaughan discovered the same poison in milk kept for a time in his laboratory. On experimenting with the substance Dr. Vaughan found that it reproduced itself, and hence concluded, apparently with good reason, that it was the product of some micro-organism, which has, however, not yet been isolated. This ptomaine, which Dr. Vaughan named tyrotoxin, has also been found by Drs. W. K. Newton and Shippen Wallace in milk which produced poisonous symptoms in seventy-three persons at a New Jersey summer resort. All other sources of poisoning were rigidly excluded.

Prof. Shearer, chemist to the Iowa State Board of Health, has isolated this poison from samples of milk which had produced poisonous symptoms. He also found the poison in the vomited matters of persons taken sick in an outbreak of milk poisoning, at Corning, Iowa.

Dr. Vaughan has suggested that tyrotoxin may be the active cause of cholera-infantum. He has reported a case of this disease in which the agency of

the poison in its causation seems very probable. The matter is of such great importance in view of the immense annual mortality from cholera-infantum in this country, that it deserves careful study.

In this connection it may not be superfluous to point out the apparent causes of the development of the poison in milk. In the outbreak studied by Drs. Newton and Wallace, it was elicited that "the cows had been milked at the very unusual hours of midnight and noon, and the noon's milking—that which alone was followed by illness—was placed while hot, in the cans, and then, without any attempt at cooling, carted eight miles during the warmest part of the day in a very hot month" (August).

In view of the fact that Dr. Vaughan will himself fully describe the chemical properties and physiological action of tyrotoxin in a paper to be read before the Section on State Medicine, I may omit any further comment upon this subject here.

Closely connected with this question of poisonous food is that of food and drug adulteration. Many persons think that the assertions of sanitarians in regard to adulterations are overdrawn, but the experiences of the Massachusetts and New York State Boards of Health, contain evidence, not only as to the extent of the adulterations, but also that systematic inspection and analysis serve to diminish the practice. Of 2858 articles of food and drugs tested in Massachusetts during the first five months of 1886, 1135 were found to be adulterated or defective. Of 91 samples of "olive oil," 68 were spurious. Vinegar was found to be below the legal standard of $4\frac{1}{2}$ per cent. of acetic acid in 69 out of 116 samples. Temperance drinks all contained alcohol, some over 40 per cent., and cures for the opium habit contained opium in nineteen cases out of twenty. The last is called in the advertisement, "double chloride of gold," but the chemist sought for the precious metal in vain in the preparation. Mustard was found to be adult-

erated 124 times out of 211 samples; white pepper, 63 times out of 128 samples; black pepper, 41 out of 71; mace, 29 out of 45. Out of 9 samples of horseradish one was found to be genuine, the rest sophisticated. Molasses is "doctored" with chloride of tin, which precipitates the coloring matter and leaves the syrup of a lighter color. The poisonous precipitate is sold to the candy makers. Every one can draw his own conclusions as to the results of this practice. Citrate of iron and quinine sold in New York State contained from $3\frac{1}{2}$ to $11\frac{3}{4}$ per cent. of quinine, instead of the 12 per cent. demanded by the Pharmacopœia. 8 out of 21 samples examined contained less than 9 per cent. and 4 had less than half the proportion required by the Pharmacopœial standard. Other drugs were found similarly deficient. In view of these facts is it any wonder that physicians so frequently fail to obtain the results from medicines which they had been led to expect by previous personal experience or the observation of others?

In Germany, sanitarians are demanding that the general Government shall take cognizance of this evil and establish public laboratories where analysis of suspected articles can be made, and if found sophisticated, the dealer punished. In this country the good work being done by the State Boards of Massachusetts and New York should be imitated in all the other States. By constantly agitating this matter, the public will finally be awakened to efficient action.³

³ In this connection I would call attention to the following official announcement, found in a recent German journal. It shows that a paternal government, against which we are somewhat accustomed to declaim in this country, may have some good points.

"Under the name '*Warner's Safe Cure*,' a brown liquid contained in flat bottles holding about 500 grammes, is recommended as a remedy against kidney diseases and sold at four marks per bottle.

"The official analysis, and the statement of a resident apothecary who sells the preparation, have shown that the article consists principally of American Wintergreen, and that its highest value is not over two marks.

"This notice is published for the information of the public.

"*The President of Police*, BARON VON RICHTOFEN.
 "Berlin, March 30, 1887."

The question whether salicylic acid is harmful when added to alimentary substances as a preservative has been decided in the affirmative by a commission of the French Academy of Medicine. Prof. Brouardel, in supporting the conclusions of the commission, said that salicylic acid was most dangerous in atheromatous subjects, in old people, and in those in whom the kidneys did not act well. He advised that its use as a food preservative be proscribed. The Academy adopted this recommendation. I have been informed that the use of salicylic acid for the above mentioned purpose is extensive in this country. Health authorities might with advantage take note of the recent conclusions of foreign scientists upon this subject.

PUBLIC BATHS.

No argument should be necessary to show the importance of bodily cleanliness in the preservation of health. Free public baths have long been advocated by sanitarians, but, except in a few places, the difficulties to their general introduction have hitherto seemed insurmountable. It is easily seen that tub baths are out of the question where large numbers of people are expected to use the bathing facilities, both on account of the high first cost and the difficulties and expense of administration. It is manifest, however, that public, like private, bathing institutions must make provision for individual baths. Large pools, in which many persons bathe at once, fail to answer the requirements of sanitary science, or of public decency.

The difficulty of furnishing an individual bath for public use was first surmounted by a French army surgeon, Dunal by name. He devised a shower bath which was introduced in one of the barracks at Marseilles. This was soon imitated at other military posts in France, and at present the new French military barracks are generally supplied with a modification of the Dunal shower bath. In the German

army the same system has been adopted, and now every German soldier in barracks is required to bathe every week, the military authorities furnishing the necessary facilities: bath room, warm water, soap and towels. In circulars No. 4, S. G. O., 1871, and No. 8, 1875, Dr. John S. Billings, U. S. A., recommended the introduction of suitable bathing facilities in our own army, and in the last named publication gave an illustration of a simple but efficient bath on the Dunal system, as used in the prison at Rouen, France. The suggestion has, however, never been acted upon by the U. S. military authorities, as the question of baths for the men is left to the discretion of the post commanders. In the United States Navy, likewise, where the system could be adopted with the greatest ease, and doubtless often with benefit, no general movement toward it has been inaugurated.

The amount of water necessary for a thorough cleansing effect with the German soldiers' bath does not exceed, according to the statement of Surgeon-General Roth, of the German Army, two gallons. With the aid of a piece of soap and a little friction, a much better cleansing is obtained than when a thirty gallon tub bath is used.

It is evident that if this form of bath is the best and most economical for soldiers, it is likewise good for the civil population. With this thought in his mind, Dr. Oscar Lassar, of Berlin, had a bath of this sort constructed in the hygienic exposition in Berlin in 1883, where it seems to have attracted much attention and given general satisfaction. In a space $16\frac{1}{2} \times 40$ feet sufficient room was obtained for ten baths with all the accessories of a bath house, office, heating apparatus, drying room for towels, dressing rooms, etc. At the meeting of the German Public Health Association last year, Dr. Lassar urged the extension of these baths to the civil population, in order that every German, as he puts it, "may have his weekly bath." Dr. Lassar found that bathing es-

tablishments accessible to the public, (not free), are distributed throughout Prussia in the proportion of one bathing place to 38,000 inhabitants.

Incidentally, Dr. Lassar gives an excellent illustration of the sanitary value of free baths in some industrial pursuits. At the white lead works of Hospelt, in Ehrenfeld, there are eighty persons employed, who are required to bathe every week. Towels, soap, and all facilities necessary are furnished by the proprietor of the works. While the workmen appreciate the baths as a luxury, and make constant use of them, the proprietor reports a highly gratifying improvement in the health of the employes since their introduction. In the first year of the use of the baths (1884), the number of cases of sickness was diminished 20 per cent., and in the following year the reduction seems to have reached 50 per cent. Lead colic, especially, has become much less frequent than formerly. In the dye works of Heyl Brothers & Co., near Berlin, the firm have constructed a public shower bath of ten rooms or "cells," which is free not only to the workmen and their families, but apparently to any one that desires to make use of it. The proprietors say the baths have been of the greatest benefit to the workmen, and they express the hope that their action will be extensively imitated. The municipal government of Paris has recently authorized the erection of three large public bathing establishments in that city. Each of these is to contain a large covered pool, provided with constant in and outflow of water, which is to be heated to the required temperature in the winter season. The prices to be charged are three cents per bath to schoolboys, five cents to school-girls, and five cents to the general public. One of the baths is to be more handsomely furnished and the charge will be a little higher, in order to cover the expenses of the other two. The exhaust steam or condensed water from three large steam boiler plants belonging to the municipality will be used for

the purpose of heating the water. The item of cost, although small, will, however, limit these institutions in the good they can accomplish, looked at from a sanitary point of view.

The establishment of free baths in connection with public schools was first suggested by Dr. Carpenter, in 1877, but was not, so far as I am aware, put in practice until two or three years ago when the Mayor of Göttingen, the famous German University town, decided to introduce it into the schools. The population of Göttingen is about 21,000, and about 3,000 children attend the public schools. The baths are fitted up in the basement of one of the school-houses, where two apartments, each 8 feet 3 inches by 17 feet, were constructed, one being used as a dressing room and the other as the bath room. The walls are white-coated and the floors are asphaltum. The heating of the basement, and of the water required for the baths, does not add much to the expense of heating the building.

The baths consist of three shower baths with shallow zinc basins, 1 metre (40") in diameter. The

NOTE.—The following account of public baths erected at his own cost by Mr. Emeline, a wealthy lumberman, of Manistee, Michigan, is taken from *Good Health*. Though the enterprise is styled a company, the funds, it is said, are furnished by Mr. Emeline:

"This company was formed for the purpose of giving baths to the public at exact cost, the members of the company agreeing to give their services to the undertaking, and to give the use of \$25,000 in addition thereto.

"This company hopes ultimately to bring bathing into the public schools; that is, they hope to be able to demonstrate to the School Boards that in order to preserve the health of the scholars and teachers, and attain the best possible results as to education, it is an absolute necessity that each public school building should have a room or rooms of sufficient capacity to bathe all of its pupils once a week, and that it should be as much the duty of the teachers to see that the scholars are kept clean as it is to hear their lessons. This company has a bath house at Manistee which has a room for the children, with a capacity for bathing seventy-two per hour. The public schools have had access to this establishment for the past two or three months, with very satisfactory results.

"The children's room has dressing rooms attached, which have facilities for keeping the children's clothes separate, and the bath room is a field room with thirty-six showers. The temperature of the water used in these showers can be regulated by the person having the children in charge."

children are bathed during school hours, and the process requires so little time that a class of fifty can bathe in about one hour. Every child attending school has the opportunity of bathing once in two weeks. The children bring soap and towels with them from home. The baths are in use throughout the year. At first, this novel feature of school administration did not commend itself to the favor either of the children or their parents; but less than two months after the introduction of the baths, 75 per cent. of the children took advantage of the opportunity offered. The authorities and teachers are unanimous upon the point that the system is of great benefit to the children, not only from its direct sanitary advantage, but from the habits of cleanliness formed, to which they are likely to adhere through life.

The great sanitary importance of cleanliness has led me to make some investigations into the facilities for bathing enjoyed by the working people in this country. With this end in view, I addressed a circular letter to the Mayors of ninety-two cities, asking information upon the following points, viz.: The existence of free public bathing establishments, their number, time when open during the year, and the extent to which they are used by the public. Also the total number of residences and of buildings furnished with private baths in each city. From the answers received tables 1 and 2 give a summary of those available for statistical purposes. From table 1 it will be seen that the bathing facilities for the lower classes are absurdly insufficient, Boston making the nearest approach to an attempt to fill the want. Even here, however, the poor laborer who has no bath tub at home, and is unable to pay the charges at a public bathing establishment, is deprived of this sanitary necessity during eight months of the year.

TABLE I.
CITIES IN UNITED STATES HAVING FREE PUBLIC BATHS.

	No. of Bathing Estab- lishm'ts	Time during which the baths are in use.	No. of persons using baths.
Boston, Mass.	17	June 1 to Sept. 30.	959,765 in 1886.
Brooklyn, N. Y.	3	June to October.	225,885 in 1886.
Buffalo, N. Y.	(?)		Not very generally used
Cleveland, O.	1		Little used.
Hartford, Conn.	1		Very extensively used.
Philadelphia, Pa.	5	June 25 to Sept. 26.	581,771 in 1886.
New York, N. Y. ¹	15	June to October.	3,431,086 in 1883.

¹ Not from official reports.

TABLE II.
CITIES IN UNITED STATES NOT HAVING FREE PUBLIC BATHS.

	No. of Houses in City.	No. of Homes supplied with Bath Tubs.
Baltimore, Md.	70,000	20,000
Bridgeport, Conn.	6,000	2,000
Cambridge, Mass.	9,398	2,315
Charleston, S. C.	10,000	500
Cincinnati, O.	33,471	6,000
Lancaster, Pa.	5,600	1,000
Lynn, Mass.	5,800	1,238
Milwaukee, Wis.	25,000	3,000
Minneapolis, Minn.	17,000	3,800
New Bedford, Mass.	5,237	597
Peoria, Ill.	7,600	800
Portland, Me.	7,188	1,153
Reading, Pa.	11,000	1,900
Savannah, Ga.	6,000	4,000
Somerville, Mass.	2,000	500
St. Louis, Mo.	50,000	8,000
St. Paul, Minn.	30,000	10,000
Wilmington, Del.	12,000	5,000
	313,294	71,003

That a very large proportion of the inhabitants of our cities are deprived of proper bathing facilities is shown by table 2. Eighteen cities from which available statistics were received show that only about twenty-three per cent. of residences are supplied with bath tubs. Taking into account the difference in the numbers of persons occupying houses inhabited by the poor, and by those in easier circumstances, we

may estimate that five sixths of the inhabitants of these cities have no facilities for bathing except such as are afforded by pail and sponge, or a river, lake or other body of water which may be easily accessible. In winter even these sources of cleanliness are cut off.

I need not detain you to point out that this absence of the facilities for keeping clean is a crying evil which demands the attention of sanitarians, physicians, and in fact, all intelligent people. All are equally interested. Dirt is not only a source of disease, but probably no less a factor in the promotion of crime. I may quote here with my full endorsement the enlightened opinion of the Mayor of Reading, who says: "I am persuaded that uncleanness produces immorality and crime, for in proportion to the decrease of personal importance which an individual experiences, is he lost to the legal restrictions about him. Beclouded faces drive men from the light, and darkness breeds dangers of all kinds; so that apart from sanitary benefits, public baths would in my estimate reduce crime." I quote these words with the more pleasure, for public officials do not often bother their minds with sociological problems.

As to the arrangement of a free public bathing establishment, I agree with Lassar that the spray bath of the Dunal type, with such modifications as a more extended experience in the German army has suggested, would better fulfil the demands of sanitarians than the pool bath so generally used in these institutions. The individual spray bath is more cleansing, each person bathes in absolutely clean water—at least as pure as the supply can furnish—and the privacy secured to each bather, both in the bath and dressing room, would tend to the maintenance of morality and self respect. The economy of the spray bath, both in first cost and in administration, likewise points to it as the bath of the future especially for public purposes.

I would urgently press upon your attention the great sanitary and social importance of this reform.

SOME RESULTS OF SANITARY MEASURES.

In determining the results of sanitary measures, errors of observation, or of inference are very liable to creep in and vitiate our conclusions. However, in a number of instances, after making all reasonable allowances for such errors, we may conclude that a reduction of the usual death rate of a place following upon the enforcement of sanitary measures, and continuing during the time such measures are carried out, is fairly due to the agencies mentioned. As a fit conclusion to this summary of progress, I have thought it not inappropriate to group together a number of instances where the inference that the improvement was due to sanitary measures seems justified by the evidence upon record. I have already called attention to the fact that in the State of Michigan the saving of life during a period of efficient sanitary administration amounted to 3,718 lives from a single disease (scarlet fever) in eleven years, or 338 per year.

In a communication to the Michigan State Medical Society on May 13, 1887, Dr. Baker gives some suggestive statistics showing the results of isolation and disinfection in restricting diphtheria. There were in 1886, 461 outbreaks of diphtheria in Michigan, exclusive of Detroit and Grand Rapids. In 243 of these it is uncertain whether any measures of isolation or disinfection were taken. In 102 outbreaks isolation and disinfection were both neglected, and in 116 outbreaks isolation and disinfection were both enforced. The sequels of these outbreaks were as follows:

In the total of 461 outbreaks there were 3,085 cases and 656 deaths, an average of 6.69 per cent. of cases and 1.42 per cent. of deaths. In the 243 outbreaks where it is doubtful whether proper re-

strictive measures were taken, the cases were 1,103, with 250 deaths, an average of 4.54 of cases and 1.03 of deaths. *In the 102 outbreaks where no measures were taken, the cases numbered 1,650 and deaths 329, an average of 16.18 per cent. of cases and 3.23 per cent. of deaths.* Contrasted with this, we have 116 outbreaks in which both isolation and disinfection were enforced, with only 332 cases and 77 deaths, an average of 2.86 per cent. of cases to each outbreak and only .66 per cent. of deaths. Dr. Baker points out that according to these statistics 1,545 cases and 298 deaths from diphtheria were prevented during the year 1886, in his State. If these results do not show conclusively the effects of appropriate sanitary measures, then figures are most abominable liars.

In Great Britain, it is estimated by Dr. Ogle that sanitary improvements have had the effect of adding 1.44 years of life to every male, and 2.77 years to every female in England and Wales, and Mr. Edwin Chadwick is quoted as saying that "the changes in the death rate have given to the community an annual addition of 1,800,047 years of life shared among its members; and allowing that the changes in the death rates are the direct consequence of sanitary interference, we must regard this addition of nearly two million years as an annual income derived from the money invested in sanitation." If we put this saving of life in round numbers, we find that in the five years 1881-5, there has been an annual saving of the lives of 62,000 persons in England and Wales, which would have been lost in default of the sanitary measures enforced. Capt. Douglas Galton estimates the annual saving of life in Great Britain in 1880 84 at 102,240. This is on the assumption, of course, that no other causes could or did produce this saving of life. It is greatly to be regretted that in this country we have no such system of vital statistics as will enable us to "take an account of stock," which would show whether we are making similar progress.

But, if we could do so, such a reduction in the death rate among our 60,000,000 people would show a saving of the lives of 144,000 persons per year. Certainly this is worth striving for.

In Holland a law to restrict the spread of infectious diseases went into effect in 1872. Comparison between the mortality before and since that year shows that there has been a decrease in the number of deaths from typhoid fever, small-pox, scarlet fever, measles and diphtheria. The measures relied upon were isolation and disinfection.

When we reflect that in the year 1885 there were 2,374 deaths from measles and scarlet fever in the State of New York, the inquiry presents itself forcibly whether a rigid system of notification, isolation and disinfection carried out under the authority of an efficient health officer, could not greatly reduce and in time wipe out the mortality from such purely contagious diseases.

Another instance showing the effectiveness of prompt isolation and disinfection in stamping out a beginning epidemic, is afforded by the incident of the outbreak of yellow fever at Biloxi, Miss., last summer. The measures taken have been already pointed out in sufficient detail on a preceding page.

In my native city of Baltimore, it is claimed by the health department that certain infectious diseases have been reduced markedly since the introduction of a thorough system of plumbing inspection. During the same time, however, isolation and disinfection have been more thoroughly practiced, and doubtless most of the good results are due to these features of the sanitary administration.

In Memphis, which has for six years past been the cynosure of all sanitary eyes in this country, the improvements, initiated by the National Board of Health, and so efficiently carried out by the local board under the presidency of Dr. George B. Thornton, have resulted in reducing the total death rate from 35 per thousand to 23.80 per thousand.

In this great metropolis of the West, whose bountiful hospitality we are now enjoying, I find it stated that during the last five years the death rate has decreased from 25.69 per thousand to 19.46 per thousand, an apparent net saving of 17,214 lives in that period, due probably to the enforcement of sanitary measures. Other instances of the same sort could be cited. I have quoted the above merely to point out the way in which, it seems to me, the practical sanitarian should direct his forces in the struggle with communicable diseases. First of all the health authority must ascertain the presence and locality of every case of contagious or infectious disease. This can only be done by requiring the physician to promptly report every such case that comes to his professional knowledge. I am quite aware that many physicians contest the right of the State or municipality to exact compliance with laws requiring them to report such cases. Some contend that such notification is a violation of professional secrecy, but the majority object because the State offers no pay for service performed. The latter objection seems to me valid; physicians do not owe the State gratuitous service, any more than do other professions. The ethical objection appears to me the height of absurdity. I beg leave to quote upon this point the remarks of Dr. Ezra M. Hunt: "If Boards of Health," says Dr. Hunt, "have as one of their objects the prevention of the extension of communicable diseases, it would seem to follow as a corollary that they have the right to know where such diseases exist. It is a parody on ethics to class as professional family secrets, the concealment from a health officer that there is small-pox in Mr. A's family, or that Mr. B's children are having the scarlet fever or diphtheria. Nor can any judicial decision be found to sustain any, who, under the assumption of an invasion of personal rights, claim that the law has no right to oblige those in attendance upon cases of

contagious disease to help guard the public health."

The *first* requirement then in dealing with infectious diseases from "a State Medicine point of view" is *notification*, and inasmuch as such notification will never be effective if voluntary, it must be made compulsory.

The *second* requirement in restricting the prevalence of such diseases is the segregation of patients, and guarding healthy individuals, except the immediate attendants, from contact with them. This is evident to all intelligent persons at first thought.

The *third* requirement is prompt and thorough disinfection, in other words, the absolute destruction of the infective properties of infectious matter, in whatever that may consist. For a number of diseases the infectious material itself, as well as the modes by which it is given off from the patient or communicated to healthy persons are known. For others we may venture a probable guess.

Recent studies upon disinfectants have pointed out those which are trustworthy, and removed difficulties in their practical application.

I would therefore declare the watchwords of the practical and progressive sanitarian in dealing with communicable diseases to be these three: *Notification, Isolation, Disinfection.*

